A SURVEY OF THE

Herpetofauna of the Yathong Nature Reserve

NEW SOUTH WALES

Abstract

During two herpetofaunal surveys in February and March 1985 27 species of amphibians and reptiles were found in Yathong Nature Reserve. Mallee sandridges were richer in number of specimens than mallee on flat sandy soil. Open grassland, strongly influenced by former land-use, was less rich in species than mallee areas but supported the same number of specimens as the mallee on flat sandy soil. The herpetofauna of Yathong Nature Reserve is very similar to that of Round Hill Nature Reserve.

Introduction

Many community studies make frequent reference to Pianka's (1969a+b) and Pianka and Pianka's (1976) studies of the lizard communities in arid environments in Australia. Therefore, it is astonishing that only a few other publications exist on the herpetofaunal communities of Australia's semi-arid or arid zones. Cheal *et al.* (1979), Caughley (1985), Cogger (1984), Mather (1979), Mebs (1975), Menkhorst (1982) and Rawlinson (1966) have examined the herpetofaunal or reptile communities of the semi-arid mallee belt of western New South Wales and Victoria, and Bustard (1968) the reptiles of the less arid Pilliga scrub, while Longmore and Lee (1981) report on the herpetofauna of the arid mulga in Sturt National Park. Additionally, Cogger (1974, 1978) published an account on the ecology of one typical mallee reptile, *Ctenophorus fordi*.

With this paucity of knowledge even annotated species lists for malee areas are of interest, especially as the mallee associations have suffered extensively from farming activities and fragmentation through clearing during the wheat boom (Ehmann and Cogger 1985). This paper reports on a preliminary herpetological survey in a mallee area which is only partially affected by former land-use.

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Study Area and Methods

Yathong Nature Reserve is situated in New South Wales approximately 25 km NW of Mt Hope between 145°26'-145°42'E and 32°25'32°47'S (Fig. 1) and lies mainly between 200 and 250 m above sea level but in the south-east of the reserve the northern extension of the Merrimerriwa Range reaches 465 m. Low parallel sandridges cross the flat western part of the reserve.

The vegetation of the reserve consists mainly of two different mallee associations, one on sandridges and one on flat sandy soils, but large *Callitris* forests are present in the eastern and the southern central parts. The area around the former sheepshearers' quarter is an open grassland (*Stipa "variabilis"* dominating) with only a few scattered trees. The study area was visited twice in 1985, from February 5 to 9 and from March 19 to 29.

Pitfall traps in the form of plastic buckets 25 cm in diameter and depth were used in the first survey. Buckets were placed approximately 10 m apart either in a single line of 10 traps or in a 3 × 4 grid. The traps were partly covered with twigs. Traps were placed in four habitats: in open grassland, in old mallee with hardly any spinifex-grass (*Triodia irritans*), in sandridge mallee with spinifex-grass dominating and in moderately dense spinifex-grass on plain, hard, sandy soils mixed with gravel. Additionally, spot-lighting was conducted during one night in mallee and in open grassland. The granitic outcrops were surveyed late one afternoon.

In the second survey three study plots of 5 × 5 pitfalls spaced 5 m apart were set up in sandridge mallee (Site 1) along the southern fire trail, on flat soil mallee (Site 2) near the northern boundary of the reserve and in the *Stipa*-grassland (Site 3) at Yathong shearers' quarters (Fig. 1). Eleven litre aluminium ice cream containers were used as pitfall traps. In each plot 7 × 3 and 2 × 2 pitfalls were connected with plastic drift fences approximately 20-25 cm high with the lower edge buried 5 cm deep in the earth. All pitfalls were opened on the same day and left open for nine days and nights. All traps were checked daily in the morning. At a later stage two further study plots were set up immediately adjacent to Site 1, each a 5 × 5 grid but without drift fences; these traps were opened for three days and nights.

Gross vegetation and soil in the study plots were as follows:

Site 1: Soft sandy soil, 50% bare, 35% *Triodia irritans*, 15% mallee (*Eucalyptus dumosa, E. socialis, E. gracilis* and *E. foecunda* in roughly equal numbers).

Site 2: Soil sandy with hard crust; 40% bare, 25% *Triodia irritans*, 25% mallee (*Eucalyptus dumosa, E. socialis, E. gracilis*), 5% *Acacia* sp., <5% small annuals; Leaf litter underneath *Acacia* and *Eucalyptus*.

Site 3: 10-30 cm depth of gravel/sand on sand or gravel/sand subsoil; 50% bare, 50% *Stipa "variabilis"* (about 80% of the bare area was covered with dead grass and remains of ephemeral forbs).

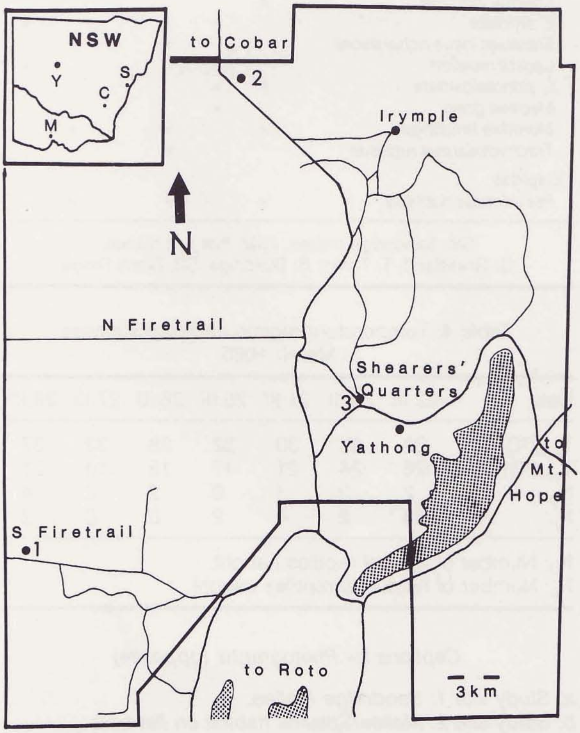


Figure 1: Main survey sites (dot 1-3) in Yathong Nature Reserve. Stippled: Merrimerriwa Range. Inset: C: Canberra, M: Melbourne, S: Sydney, Y: Yathong.

The vegetation of the plots adjacent to Site 1 was similar to that of Site 1. Additionally to the pitfall trapping the granitic outcrops were surveyed during two afternoons and evenings and spot-light surveys were made at the tank at Irymple and around the shearers' quarters at Yathong.

Daily maximum and minimum temperatures were recorded by John Warren at the Yathong ranger station.

All statistical procedures follow Sachs (1982).

Taxonomy follows Cogger (1986) except for the inclusion of *Lucasium damaeum* in the genus *Diplodactylus* (see Kluge 1967).

Results

During the February survey only lizards were observed. Table 1 summarizes the results of the pitfall trapping. Although the difference in trap success reaches significance ($\chi^2_1 = 4.65$; $0.01 < \alpha < 0.05$) there is neither a significant difference between sandridge and old mallee nor between the *Stipa* and the Spinifex area (Fisher's exact test: p = 14% and p = 7% respectively).

Table 1: Pitfall trapping results in February.

Study plot	Trap days	Number caught	Catch rate
Stipa grassland	13	5	39%
Sandridge	21	3	14%
Spinifex	36	5	14%
Old mallee	36	1	3%

During the March survey lizards and frogs were caught. The difference in trap success between the three sites ($\chi^2_2 = 5.568$; $0.05 < \alpha < 0.1$) (Table 2) is only marginally significant. The simultaneous comparison of sandridge versus flat soil mallee and mallee versus *Stipa*-grassland shows marginal significance for the former but not for the latter comparison ($\chi^2_1 = 4.241$, $0.05 < \alpha < 0.1$ and $\chi^2_1 = 0.662$, $\alpha > 0.1$). Furthermore, on Site 1 seven House Mice (*Mus musculus*) were trapped and two additional reptile species (*Ctenotus regius, Pseudonaja nuchalis*) were seen while on Site 2 one

Table 2: Reptiles and amphibians caught in pitfall traps from March 21 to 29, 1985.

Vegetation	Trap days	Number caught	Catch rate	Number of species
Site 1	225	19	8%	10
Site 2	225	8	3.5%	7
Site 3	225	10	4%	3

Sminthopsis murina was trapped and three further reptile species (*Ctenophorus fordi, Ctenotus regius* and *C. robustus*) were observed. On Site 3 two further reptile species (*Trachydosaurus rugosus, P. nuchalis*) were seen during the February survey but not in March.

The comparison of Study Plot 1 with drift fences and the adjacent study plots without drift fences was run for three days. In this period two and three specimens were caught in the plots without drift fences and five in the one with drift fences. The time interval for the comparison is too short to demonstrate any difference between the plots with such a low trapping success. Direct observations in the study plots with drift fences gave equivocal results. Some individuals, especially *Ctenotus* spp., were not guided to traps by the drift fences and climbed readily over them while one *Ctenophorus fordi* was observed running along a drift fence and jumping straight into a trap.

Table 4 summarizes the influence of temperature on trap success in the three study plots. Neither minimum temperature ($r = 0.51$; $t = 1.326$, $\alpha > 0.05$) nor maximum temperature ($r = 0.44$; $t = 1.096$, $\alpha > 0.05$) are significantly correlated with the number of nocturnal and diurnal reptiles caught.

The Species

All species trapped or sighted in Yathong Nature Reserve are listed in Table 3. All species were found only in low numbers throughout the areas surveyed, except for *Ctenophorus fordi* which was seen frequently on one sandridge, where about 0.5 ha of mallee with spinifex-grass was completely surrounded by recently burned areas. It is noteworthy that *Nephrurus levis* was the only species found regularly in the mallee areas surveyed as well as on the grasslands. Additionally three *N. levis* which could be individually recognized because of toe-losses and/or pattern, lived in a 600 m^2 area around the huts on which the cover of low plants amounted to only about 20% of the total zone. This is in marked contrast to the situation Pianka and Pianka (1976) describe for their Western Australian arid study areas in which *Nephrurus levis* is restricted to spinifex-sandplains with or without a eucalypt canopy. In the areas where this species was not present, in spinifex-sandridges, spinifex-mulga habitats, mulga and scrub deserts, other species of *Nephrurus* lived. As Pianka and Pianka (1976) found a high ecological overlap between *Nephrurus* species the smaller ecological range of *N. levis* in Western Australia may be due to competitive exclusion.

Morethia boulengeri which was encountered only rarely in mallee vegetation was seen regularly in the low vegetation and underneath wood around the sheep-shearers' quarters and at Irymple. A single specimen of

Table 3: Reptile and amphibian species recorded in Yathong Nature Reserve.

Species	Site: SM	FSM	G	T	B	SR
AMPHIBIA:						
Myobatrachidae:						
Limnodynastes interioris		×		×		
L. tasmaniensis				×		
Uperoleia rugosa			×			
Litoria rubella					×	
REPTILIA:						
Gekkonidae:						
Diplodactylus damaeus	×					
Gehyra variegata		×		×	×	
Nephrurus levis	×	×	×		×	
Rhynchoedura ornata	×	×				
Agamidae:						
Ctenophorus fordi	×	×				
C. pictus	×	×				
Pogona vitticeps	×		×			
Varanidae:						
Varanus gouldii	×	×				
V. varius		×				
Scincidae:						
Cryptoblepharus carnabyi						×
Ctenotus atlas	×	×				
C. regius	×	×				
C. robustus		×				×
C. schomburgkii	×	×				
Egernia inornata	×					
E. striolata		×				×
Eremiascincus richardsonii			×			
Lerista muelleri		×				×
L. punctatovittata	×	×				
Menetia greyi		×				
Morethia boulengeri	×		×		×	
Trachydosaurus rugosus			×			
Elapidae:						
Pseudonaja nuchalis	×		×		×	

SM: Sandridge mallee; FSM: Flat soil mallee;
G: Grassland; T: Tanks; B: Buildings; SR: Stony Ridge

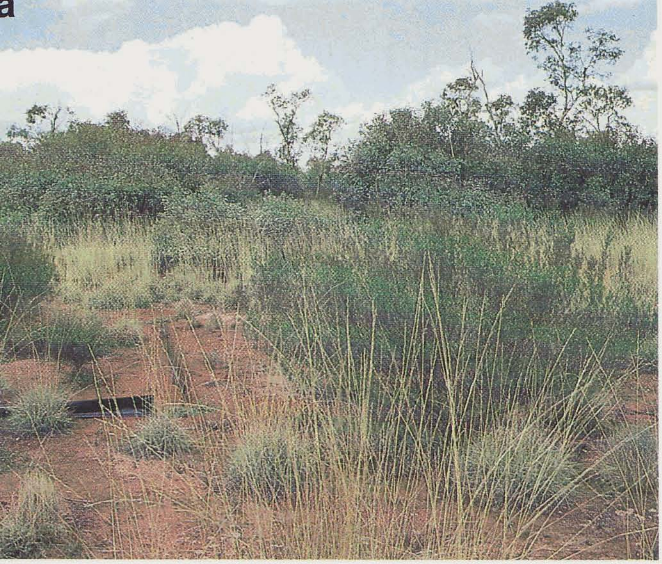
Table 4: Temperature regime and trap success in March 1985.

Date	22.III	23.III	24.III	25.III	26.III	27.III	28.III
T_{max}(°C)	32	35	30	32	28	33	37
T_{min}(°C)	26	24	21	17	18	19	21
N_d	2	3	3	0	2	2	4
N_n	3	2	4	2	0	0	3

N_d: Number of diurnal reptiles caught.
N_n: Number of nocturnal reptiles caught.

Captions for Photographs (opposite)

a: Study site 1: Sandridge Mallee.
b: Study site 2: Mallee/Spinifex habitat on flat soils.
c: Study site 3: Stipa "variabilis" grassland.
d: Ctenotus schomburgkii.
e: The Giant Banjo Frog (Limnodynastes interioris).
f: Desert Skink (Egernia inornata).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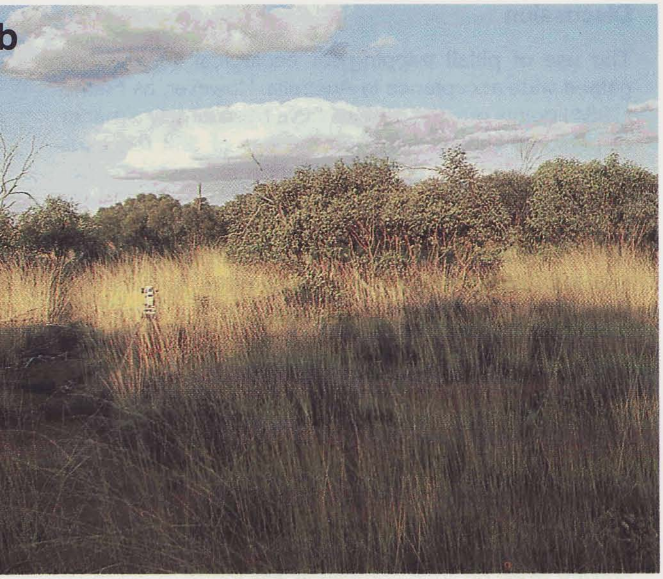
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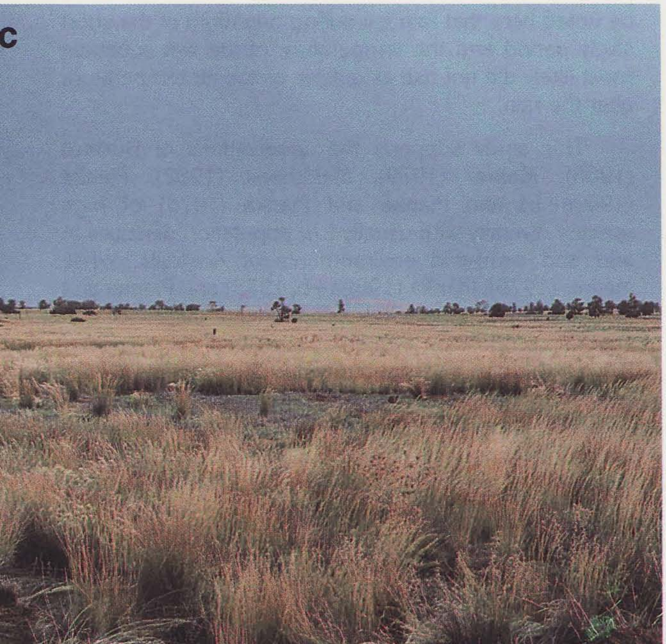
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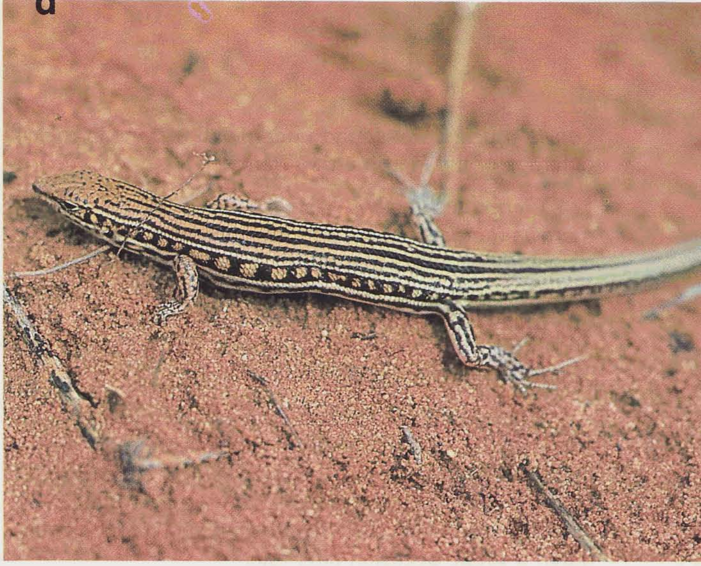
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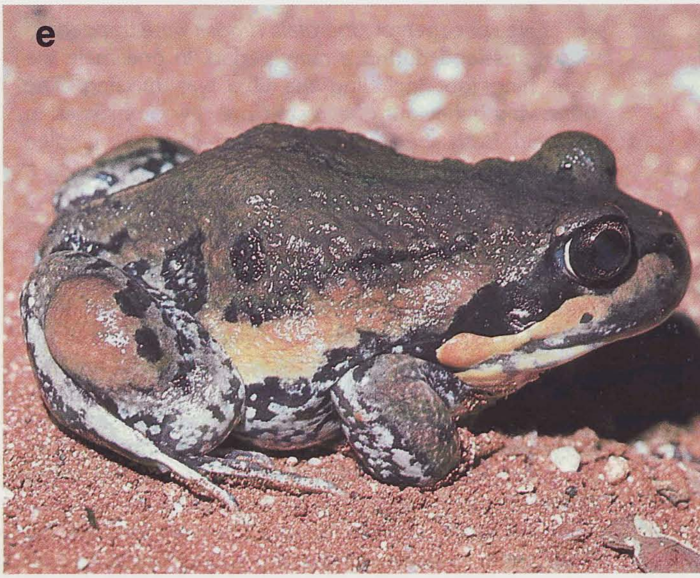
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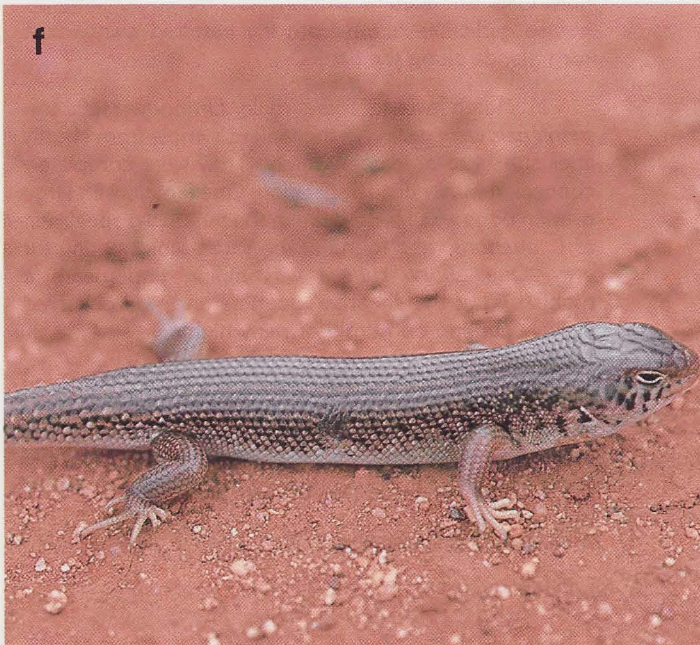
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Lerista muelleri was found underneath a stone in rocky outcrops of the Merrimerriwa Range.

Ctenotus robustus also occurred in the Merrimerriwa Range; an adult specimen was found in a night retreat underneath a tree stump in an open *Callitris* stand and a juvenile in a night retreat underneath a stone in rocky outcrops. While the adult corresponded in size, pholidosis and marking to typical *C. robustus*, the juvenile specimen was atypical.

All capture sites of *Eremiascincus richardsonii* were concentrated around a large rabbit warren in stony grassland thus confirming Greer's (1979) statement of its preferred ecological habitats. Several specimens (two juveniles, one adult) of *E. richardsonii* were trapped once within a single occasion after rain.

Five specimen of *Uperoleia rugosa* were trapped on *Stipa*-grassland during a rainy period. In one male the right hind foot including the tibia was missing. The burrowing behaviour of two specimens was observed in the field. Both specimens used alternately their hindleg to push the earth front and sidewards. After creating a small depression they push themselves into it with the frontlegs and continued digging. One specimen changed its orientation repeatedly about 30° to both sides of the original axis and rotated at least another 90° underneath the soil before it rested, while the other animal maintained its original orientation. Both frogs stopped burrowing approximately 2 cm below the surface. Thus one specimen exhibited clearly the backwards-sliding burrowing behaviour while the other reminded one of the circular burrowing of *Notaden* and *Neobatrachus* which stands in contrast to the laboratory observations of Sanders and Davies (1984) who noted no intraspecific variation in the species examined by them. As a defence mechanism against handling two individuals secreted a whitish viscous liquid with an intense garlic-like odour from the parotoid glands and from glands along the flanks.

In March two to three male *Limnodynastes tasmaniensis* were calling at the tank at Irymple from shortly after sunset to at least midnight. They were completely concealed within dead vegetation. One female with large ovarian eggs was found dead in the tank. Two specimen of *L. interioris* were found at the same tank hunting for prey. One *Litoria rubella* was hiding underneath a rubbish tin at the shearers' quarters and was observed actively hunting on humid or rainy nights.

Gehyra variegata was commonly seen hunting at night around the lights at Yathong station, but it was rare at the shearers' quarters which are seldom lit at night. It was rare to common on trees around the tank at Irymple and on large eucalypts in burned areas bordering mallee.

Ctenophorus pictus was regularly seen along roadsides but never more than 3 m off the road edges and usually stayed close to large *Triodia* clumps.

One adult *Varanus gouldii* was seen sun-basking on a road edge in burned mallee and a juvenile was caught in sandridge mallee. One adult and one juvenile *V. varius* were observed foraging in burnt areas.

A small population of *Cryptoblepharus carnabyi* lives on bark and thorny bushes near the Yathong ranger station and on the rocky outcrops of the Merrimerriwa Range. *Egernia striolata* was frequently observed basking indirectly in large and deep rock fissures of the Merrimerriwa Range and once in a large tree hollow in which also several specimens of *Gehyra variegata* lived.

Discussion

The use of pitfall trapping for ecological surveys has gained wide acceptance in Australia. However, as Friend (1984) points out, the designs have been largely a matter of personal choice. Although the use of drift fences is often regarded as improving the trap success, no published data clearly establish this for any Australian reptile or amphibian. Gibbons and Semlitsch (1981) demonstrated that drift fence techniques increased the trap success for some but not for other species in a South Carolina ecosystem. The data of this survey did not demonstrate such an improvement but the number of comparisons were low and therefore could have detected only a large increase. Clearly more intensive studies are needed.

Menkhorst (1982) reports that the trap success depends on maximum air temperatures for diurnal species. Unfortunately, his catch effort was not constant and the correlation not tested for significance. In the present study no such correlation was found. But it must be noted here that rain fell during one night of the short study period and the temperature of the wet substrate most likely did not rise as quickly as the air temperature after the rain.

This study supports the observations of Bustard (1968), Mather (1979), Menkhorst (1982), Pianka (1969a+b) and Pianka and Pianka (1976) of high species diversity with usually low population densities in arid and semi-arid environments of Australia. While Mather (1979), Pianka (1969a+b, 1973) and Pianka and Pianka (1976) emphasize pronounced differences in species composition with small structural differences of habitat, this was not pronounced in Menkhorst's (1982) and the present study. Only the highly modified *Stipa* grassland showed a markedly different and depauperate species composition (Tables 2 and 3), but the trap success in it was as high as in mallee. This implies that either fewer species live in the grassland but at higher population densities or that the catchability of these species is higher. The February survey data are difficult to interpret due to the variable trap design.

Comparison between semi-arid/arid areas in eastern Australia, for which data are published, are hampered by differences in sampling methods, efforts and/or seasons of the surveys. Nevertheless, a close resemblance of the herpetofaunas at Yathong and the nearby Round Hill Nature Reserve (see Cogger 1984 and Caughley 1985), which has a similar vegetation, is apparent. The main difference is the underrepresentation of pygopodids and snakes in Yathong, probably due to their usually low population densities and secretive habits, making a detection in short surveys unlikely. The absence of *Nephrurus levis* and *Gehyra variegata*, the two most common geckos in Yathong, from the Round Hill Nature Reserve species lists provided by Cogger (1984) and Caughley (1985) is remarkable. *G. variegata* may have been overlooked as these authors relied mainly on pitfall sampling, but *N. levis* would have been detected by this method if common.

Acknowledgement

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